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Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):
Barasa, L., Kinyanjui, B., Knoben, J., Kimuyu, P., & Vermeulen, P. A. M. (2016). *Export and Innovation in Sub-Saharan Africa*. (pp. 35). (DFID Working Paper). Radboud University Nijmegen.

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EXPORT AND INNOVATION IN SUB-SAHARAN AFRICA

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This research was funded with support from the Department for International Development (DFID) in the framework of the research project ‘Enabling Innovation and Productivity Growth in Low Income Countries’ (EIP-LIC/PO5639)

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EXPORT AND INNOVATION IN SUB-SAHARAN AFRICA

ABSTRACT

Our study seeks to examine the bi-directional relationship between innovation and exporting in four countries in Sub-Saharan Africa. We hypothesize that there is a positive relationship between innovation and subsequent exporting, and that this relationship is mediated by market creation. We also hypothesize that there is a positive relationship between exporting and subsequent innovation, with customer feedback mediating this relation. We analyze firm-level data from a repeated cross-sectional survey design from the 2006/07 and 2013 World Bank Enterprise Surveys and 2013 Innovation Follow-up survey. Our results show that the relation between innovation and subsequent exporting is positive and significant. However, we find a positive but non-significant relation between exporting and subsequent innovation. These relations broadly nuance a bi-directional relationship between innovation and exporting. Furthermore, we find that market creation significantly mediates about 32.5% of the effect of innovation on subsequent exporting. Similarly but to a much larger extent, customer feedback is found to significantly mediate about 67.4% of the effect of exporting on subsequent innovation.

Keywords: Innovation, exporting, market creation, customer feedback, mediation, Sub-Saharan Africa

1. INTRODUCTION

The link between innovation and exporting has received considerable attention (Love & Roper, 2015; Rodil, Vence & del Carmen Sánchez, 2015; Cassiman & Golovko, 2010). One strand of research investigates complementarity between exporting and innovation (Golovko & Valentini, 2011; Filatotchev & Piesse, 2009) while the other examines the direction of causality (Filipescu, Prashantham, Rialp & Rialp, 2013; Damijan, Kostevc & Polanec, 2010; Hahn & Park, 2012). Nevertheless, few studies take into account the possibility of both causalities occurring simultaneously (Salomon & Shaver, 2005). Furthermore, a majority of these studies have been conducted in developed countries. Hence, there is an apparent dearth of literature disentangling the mechanism of the innovation-exporting relationship, specifically in developing countries and more so in Africa. George, Corbishley, Khayesi, Haas, and Tihanyi (2016) argue that there is a paucity of studies shedding light on under-researched phenomena that remain serious concerns for business in Africa. For instance, previous studies find evidence of learning by exporting in Sub-Saharan Africa (SSA) (Bigsten et al., 2004; Bigsten & Gebreeyesus, 2009; Van Biesebroeck, 2005) implying that participation on international markets facilitates knowledge flows from customers and competitors. Yet, it remains unclear how this mechanism affects the exporting-innovation relation in SSA⁴.

We argue that there is a bi-directional causal relationship between innovation and exporting in Africa. Chadha (2009) suggests that innovation directly influences exporting behavior because firms apply innovation as a strategy for gaining an international market share. A firm's ability to successfully compete on the international market is influenced by its capacity of introducing and

⁴ Our study sample consists of firms located in SSA including Ghana, Kenya, Tanzania, and Uganda.

marketing both new and improved products (Filipescu et al., 2013). Conversely, exporting influences the likelihood of innovation (Hahn & Park, 2012). This may occur in two ways. First, the export market is a potential source of information that directly affects the likelihood of innovation (Crespi, Criscuolo, & Haskel, 2008). Furthermore, firms are likely to gain valuable knowledge from the export market that leads to subsequent innovations. Secondly, pressures arising from high demand on international markets may push participating firms to innovate (Di Stefano, Gambardella, & Verona, 2012). Our study therefore departs from previous studies focusing on innovation, exporting and productivity (Caldera, 2010; Ganotakis & Love, 2011; Cassiman & Golovko, 2010; Cassiman, Golovko, & Martinez-Ros, 2010; Crespi & Zuniga, 2012) since we examine how market sources of information link the relation between innovation and exporting.

We posit that there are two different mechanisms accounting for the bi-directional causal relationship between innovation and exporting. These mechanisms comprise the two primary sources of innovation including technology-push innovation and demand-pull innovation. Technology-push innovation occurs when research and development (R&D) drives the introduction of new products for exporting. Hence, technology-push innovation relates to the supply side factors arising from technological advances. Nevertheless, it has been argued that it is the creation of new products and services that matters for the export market rather than investment in R&D (Ganotakis & Love, 2011). Conversely, demand-pull innovation relates to demand side factors including the need for new or significantly improved products arising from foreign markets (Norman & Verganti, 2014). Additionally, we argue that whilst there is a likelihood of market creation mediating the relation between innovation and exporting within the technology-push mechanism, customer feedback is more likely to mediate the relation from

exporting to innovation within the demand-pull mechanism. Our study employs data from a repeated cross-sectional survey design covering a 7-year period that enables us to draw conclusions regarding causality. Two waves of the World Bank Enterprise Survey (WBES) carried out in 2006 for Uganda and 2007 for Ghana, Kenya, and Tanzania respectively, and the 2013 WBES including the 2013 World Bank Innovation Follow-up Survey (IFS) module are merged giving a representative account of export behavior and innovation activities of the reporting firms for the period covering years 2006/07-2012.

Our main research question is whether there is a bi-directional causal effect between innovation and exporting in SSA. Specifically, we seek to find out how technology-push innovation drives exporting, and how exporting drives demand-pull innovation by examining the underlying mechanisms of this interrelationship.

1.1 Research context

Innovation, which is defined as the introduction of new or significantly improved products or services (Oslo, 2005) is inherently context specific (Baskaran & Mehta, 2016). Lack of systematic studies on innovation in Africa poses a major challenge in understanding innovation in the context of developing countries in SSA. Small and underdeveloped markets arising from high levels of illiteracy and low per capita income, and poor infrastructure characterize countries in Africa. These features significantly influence technology-push and demand-pull innovation, which represent the supply side and demand side respectively. Baskaran and Muchie (2013) argue that levels of literacy and per capita income largely account for demand-pull innovation. Yet, countries in Africa report high levels of illiteracy and low per capita income. In particular, low levels of literacy hinder consumers from articulating demand, which is a major obstacle to demand-pull innovation. Furthermore, a majority of firms do not conduct R&D, and also face

poor telecommunications and energy infrastructure presenting obstacles to technology-push innovation in Africa (Baskaran & Muchie, 2013). Notwithstanding, innovation ideas and technology development options predominantly arise from the supply side in the context of SSA. Successful radical innovations are typically rare (Norman & Verganti, 2014). Nevertheless, M-Pesa⁵, a Kenyan based mobile money transfer service offered by Safaricom, is one of world's most successful financial innovations. M-Pesa has been classified both as a radical and disruptive innovation. We provide a more detailed discussion on the origins and exporting of M-Pesa services in the following section in a bid to shed light on features of technology-push innovation in SSA. We also present an illustrative example of demand-pull innovation to provide more insight into how this mechanism works in the context of SSA. In particular, we highlight the factors that play a significant role in explaining how exporting leads to demand-pull innovation by examining the innovation-exporting mechanism of The Kikoy Mall EPZ Limited, a Kenyan based textile and clothing enterprise. Accordingly, the M-Pesa and Kikoy Mall EPZ Limited are illustrative examples of technology-push, and demand-pull innovation in Africa.

1.2 Technology-push innovation: The case of M-Pesa

M-Pesa has been described as the most successful and largest mobile money transfer service in the world (Mas & Morawczynski, 2009). The origins of M-Pesa are traced back to the conceptualization of a money transfer service by researchers for meeting the needs of the unbanked population. This idea was developed by a team of researchers and Safaricom, an affiliate of United Kingdom's (UK) Vodafone Group following which the M-Pesa service was introduced to the market. The development of M-Pesa involved intensive investment in R&D for

⁵ The name M-Pesa is a combination of an abbreviation and a Swahili word. "M" stands for "Mobile" while *Pesa*, is a Swahili word for money. Hence, M-Pesa means mobile money.

designing and developing the money transfer software. Additionally, Safaricom engaged in extensive market creation activities aimed at pushing the uptake of the M-Pesa service in both rural and urban areas. M-Pesa can be termed as a financial inclusion breakthrough in SSA. The potential applications of M-Pesa have evolved over time to include formal banking transactions. This implies that potential applications of the money transfer services were largely unknown during its development. M-Pesa services have been exported to Tanzania, Uganda, Rwanda, India, Egypt, Afghanistan, Romania and Albania.⁶

M-Pesa was developed by means of R&D involving basic research, following which the money transfer service was developed and successfully marketed domestically and internationally. The distinctive features that classify M-Pesa as a technology-push innovation include the fact that it was an idea from an R&D team that initiated the development of a new product based on their knowledge of users' needs (Hughes & Lonie, 2007). In addition, potential users were not involved in providing input regarding the product specification and design. Hence, the innovation compulsion arose from R&D with the market being viewed as a receptacle for the product. From the outset, scientific and technological skills were applied for inventing the mobile money transfer service. Yet, the specific need for mobile money transfer services did not exist because the market had not identified such a need. Hence, the success of M-Pesa is attributed to encouraging a latent need by providing the market with an innovative product (Mas & Morawczynski, 2009).

⁶ M-Pesa has been less successful in other countries relative to Kenya. This has been attributed to pervasive financial exclusion that made M-Pesa a viable option for a majority of Kenyans. In addition, M-Pesa conformed to culturally accepted forms of traditional exchange in Kenya that involved the transfer of money through third parties.

The M-Pesa launch involved significant investment in branding and marketing indicating a strong market opportunity. Extensive marketing carried out in the initial stages included advertising by medium of television and radio, roadshows, tents, and expansive sales-points. A 2008 survey of 1,210 M-Pesa users revealed that about 70 percent of the users first heard about M-Pesa from advertisements on television and/or radio (Financial Sector Deepening Trust, 2009). In sum, the introduction of M-Pesa involved extensive market creation that subsequently resulted in exporting of the M-Pesa services. Thus, market creation activities were the major driving force underlying the technology-push mechanism exhibited by M-Pesa.

1.3 Demand-pull innovation: Kikoy Mall EPZ Ltd

Kikoy Mall Export Processing Zone (EPZ) Ltd is a Kenyan based textile and clothing company specializing in Kikoy⁷ products including beach towels, leather bags and bathing robes. The idea of establishing the Kikoy production company was conceived when the entrepreneur encountered European customers who were in search of the Kikoy fabric. The entrepreneur then suggested to them that he was in a position to supply them with good quality Kikoy fabric relative to what other sellers were offering, after which he went ahead to form the company. Kikoy Mall EPZ Ltd is currently one of the largest exporters of Kikoy products in the world with Europe being its top export destination. The company began producing leather bags with an interior Kikoy lining after a customer from Spain enquired whether the firm could produce bags. A designer was hired to develop the new product in accordance to the customer's requirements for production and exporting. Hence, the innovation compulsion arose from a customer willing to express their demand and provide feedback. Furthermore, a majority of its potential clientele

⁷ Kikoy, also known as Kikoi, is a traditional Kenyan handwoven cotton wrap. The Kikoy fabric has distinctive vibrant colour combinations and designs.

also locate the company by conducting a web search for textile production firms. The factors accounting for the company's success include the production of high quality goods that comply with regulations and foreign customers' standards. The company initiates the development of new products based on both customers' requirements and requests for improvements in existing products, with the latter leading to incremental innovations. As such, Kikoy Mall EPZ Ltd is an example of a manufacturing firm engaging in demand-pull innovation that essentially arises from exposure on the international market that is characteristic of firms in SSA. In addition, customer feedback is of paramount importance for innovation at the Kikoy Mall EPZ.

2. THEORETICAL BACKGROUND

There are two conventional theories that model the innovation-exporting relationship (Wakelin, 1998). These include the neo-technology models and the neo-endowment models, which posit that causality runs from innovation to exporting. Neo-technology models, based on product life cycle theory (Vernon, 1966) and technology-gap theory of trade (Posner, 1961) argue that competitive advantage is determined by the quality of products or services produced by firms. In addition, the export demand curve shifts outwards as firms improve the quality of products and services (Grossman & Helpman, 1994). Neo-technology models suggest that some of the key factors accounting for export performance include investment in new technologies and the development of new products and services that in turn rely on linkages with other firms and the support offered by the national innovation system within which the firm operates (Metcalf, 1995). On the other hand, neo-endowment models postulate that factor endowment consisting of raw materials, skilled or unskilled labour, capital and technology determine competitive advantage (Davis, 1995). Moreover, the importance of factor-based advantages is enhanced

when a firm is a natural monopoly of a factor or is situated in an area where the factor is in abundance (Metcalf, 1995).

In contrast, endogenous growth models (Romer, 1989; Grossman & Helpman, 1991; Aghion, Howitt, Brant-Collett, & García-Peñalosa, 1998) suggest that causality runs from exporting to R&D and innovation, and provide three mechanisms explaining the exporting-innovation relationship. Firstly, intense competition from foreign markets exerts pressure on firms to invest in R&D for upgrading products and processes that enable the firm to remain competitive internationally. This entails investing in R&D in order to adopt to different sets of technological requirements in a foreign country. Secondly, exposure to superior knowledge and technology on the foreign markets gives rise to the “learning-by-exporting effect” that fosters subsequent innovation. Thirdly, economies of scale arise because exporting firms cover a larger market and increased sales may recoup R&D investment costs, providing an incentive for innovation (see Love & Roper, 2015).

In sum, existing theory indicates that diverse factors such as investing in new technologies and factor endowment (Wakelin, 1998) are key determinants of the innovation-exporting relationship. In addition, theory also supports the existence of the reverse causality relationship that is mainly driven by participation in foreign markets (Grossman & Helpman, 1991). Notwithstanding, creating markets for new products on the foreign markets is imperative for exporting performance (Ganotakis & Love, 2011). Furthermore, it has been argued that customers and suppliers on the export market often provide direct information on product development that is vital for stimulating innovation at the firm level (Clerides, Lach, & Tybout, 1998; Kafourous, Buckley, Sharp, & Wang, 2008; Salomon & Shaver, 2005). Following these arguments, we contend that market creation activities and customer feedback are likely to be the

significant mechanisms underlying the innovation-exporting relation and the reverse causality relationship in the context of SSA.

3. HYPOTHESES

In light of the highlighted theories, we observe that considerable attention has been devoted to the main effects of innovation on exporting and its reverse relationship. Yet, there is sparse literature addressing the indirect effects underlying these relationships in the context of developing countries in Africa. We hypothesize that innovation increases the likelihood of exporting in subsequent periods. Similarly, we also hypothesize that exporting increases the likelihood of innovation in subsequent periods. Furthermore, in an attempt to uncover the mechanisms underlying these relationships, we hypothesize that the innovation-exporting relation is mediated by a technology-push mechanism that involves market creation. Additionally, we hypothesize that the exporting-innovation relation is mediated by customer feedback within a demand-pull mechanism. The research context illustrates that market creation activities and customer feedback typically underlie the technology-push mechanism and demand-pull mechanism in the context of SSA. We therefore direct our attention to developing our hypotheses in the subsequent section.

3.1 Main effect of innovation on exporting

Empirical studies examining the relation between innovation and exporting in manufacturing firms find that innovation has a strong positive effect on exporting in various countries including the UK, Australia, and Germany (Ganotakis & Love, 2011; Palangkaraya, 2012; Roper & Love, 2002). Filipescu, Rialp, & Rialp (2009) suggest that firms with innovations are likely to exploit international markets for enhanced performance. Hence, the direction of causality runs from innovation to exporting (Harris & Li, 2009). Furthermore, innovative firms are more likely to

increase sales volumes and spread fixed costs of engaging in innovation activities by entering into foreign markets (Love & Mansury, 2009). Additionally, product innovation generates competitive advantage arising from cost and/or product differentiation making products more competitive in both domestic and foreign markets (Rodríguez & Rodríguez, 2005). Product innovation is likely to be vital for successful market entry and exporting (Becker & Egger, 2013) in the context of countries in Africa. Hence technology-push innovation, which is driven by advances in science and technology (Norman & Verganti, 2014) engenders exporting in what Golovko and Valentini (2014) describe as an “innovating-for-export-markets” relationship. Furthermore, Manova and Zhang (2012) argue that firms in developing countries usually upgrade their products for export to developed countries. In the case of M-Pesa, intensive R&D investment led to the development of a money transfer service with its potential applications evolving to meet the needs of international markets. Hence, there is a high likelihood of innovation preceding exporting in SSA. Thus, we propose the following hypothesis:

H1: Firms that innovate have a higher likelihood of exporting in subsequent periods.

3.2 Mediated innovation-exporting effect

Innovation brings new market offerings that are of immense value when marketed successfully (Kanagal, 2015). Furthermore, the marketing of new products is imperative for firms competing in international markets (Ganotakis & Love, 2011). Boehner and Gold (2012) show that marketing mix elements such as pricing and promotion affect market size and the diffusion of product innovations. Kanagal (2015) argues that the creation of new products is necessary but not sufficient for value creation and that new products ought to fulfil unmet demand in the market. In addition, new products must be marketed successfully for market creation to occur (Kanagal, 2015). Similarly, Vargas-Hernández and Garcia-Santillan (2011)

argue that the commercialization of new products is an important component of the innovation process. As such, intense marketing effort is required for innovations to impact sales. Marketing activities also play a key role in the diffusion of innovations because it enhances consumers' perception of the novelty of new products. Various authors suggest that the degree of integration of the R&D and marketing departments is also a key indicator of the commercial success of innovations (Becker & Lillemark, 2006; Caraballo, 2009). Building upon these arguments, we posit that whilst R&D drives innovation in the technology-push mechanism, market creation for new products is imperative for exporting. Hence, marketing innovations that aim to open up new markets and position new products and services on the marketplace are essential for market creation (Gunday, Ulusoy, Kilic, & Alpkın, 2011). Taking into account the case of M-Pesa, where we highlighted that extensive market creation activities were a major driving force underlying the technology-push mechanism, we contend that market creation activities are critical for exporting in the context of SSA. We therefore formulate our hypothesis as follows:

H2: The relationship between innovation and exporting in subsequent periods is mediated by market creation activities.

3.3 Main effect of exporting on innovation

Several studies demonstrate the link between exporting and innovation in manufacturing firms. Studies such as Ito (2012) for Japan, Hahn and Park (2012) for Korea and Salomon and Shaver (2005) for Spain and Damijan et al. (2010) for Slovenia find that exporting drives innovation. Evidence of causality running from exporting to innovation has typically been put forward by means of the “learning-by-exporting” hypothesis. Performance-based variables such as labour productivity have been used to proxy firm learning behaviour. Notwithstanding, Salomon and Shaver (2005) suggest that using innovation to measure firm learning behaviour provides a more direct examination of the “learning-by-exporting” hypothesis. The authors argue

that by engaging in exporting, firms can access foreign knowledge that enhances innovation capabilities. The illustrative Kikoy example exhibits these features particularly with regards to the firm developing new products due to knowledge flows from international customers. Furthermore, exporting can reduce innovation costs implying that subsequent innovations generate higher returns (Harris & Li, 2009). Exporting firms face competition internationally and are therefore likely to continually update their products (Bindroo, Mariadoss, & Pillai, 2012). Golovko and Valentini (2011) argue that increased global competition underscores the importance of innovation for sustained competitive advantage. Hence, we formulate our hypothesis as follows:

H3: Firms that export have a higher likelihood of innovation in subsequent periods.

3.4 Mediated effect of exporting on innovation

Support for the hypothesis that exporting leads to innovation has been demonstrated by several studies (Ito, 2012; Hahn & Park, 2012; Salomon & Shaver, 2005). Yet, the underlying mechanism often remains unclear (Harris & Li, 2009). Customer feedback relating to technical and product development plays a key role in fostering innovation (Clerides et al., 1998; Salomon & Shaver, 2005). Adner and Levinthal (2001) argue that innovation is driven by customer and market requirements because engaging customers as product co-creators is likely to yield new products. Customer feedback can also be a source of new ideas that may serve as innovation impulses. The illustrative example of demand-pull innovation shows that the innovation compulsion for Kikoy mainly arose from customers' demands and customer feedback. Furthermore, customers exhibit a variety of skills and competencies that present an untapped source of knowledge (Blazevic & Lievens, 2008). Collaboration between firms and customers is imperative for creating and sustaining competitive advantage. Taking into cognizance that a

majority of firms seek to be customer driven (Ulwick, 2002), customers now play an active role in the innovation process as value co-creators (Blazevic & Lievens, 2008). Hence, in line with the demand-pull mechanism, we contend that exporting firms in SSA are likely to innovate as a result of customer feedback arising from the international market. Thus, our hypothesis is as follows:

H4: The relationship between exporting and innovation in subsequent periods is mediated by customer feedback.

4. DATA AND METHODS

4.1 Data

Our study employs a unique dataset extracted from two waves of firm-level data from the 2006/07 and 2013 WBES that has been recently established as firm-level panel data, and the 2013 IFS survey conducted in Ghana, Kenya, Tanzania and Uganda. The WBES data contains information on various aspects of the business environment and investment climate of economies including topics such as innovation, sales and supplies, performance, finance, infrastructure and services, and business-government relations. This information is reported by owners and business managers in the non-agricultural formal sector consisting of a representative sample of firms in the manufacturing, retail and service sector. The 2013 IFS specifically reports on innovation activities of a sub-sample of the firms in the 2013 WBES and provides more detailed information on innovation than that found in the 2013 WBES. We therefore merge data from the 2006/07 and 2013 WBES, and 2013 IFS to create a more comprehensive dataset for our analysis. Our sample comprises 506 firms that participated in the 2006/7 WBES and the 2013 WBES and IFS consisting of 31 firms from Ghana, 151 firms from Kenya, 115 from Tanzania and 209 firms from Uganda. In contrast to a majority of previous empirical studies on this topic using cross-sectional analysis (see Filipescu et al., 2013), our study uses a repeated cross-sectional survey

design covering a 7-year period to examine the bi-directional relationship between innovation and exporting in SSA.

4.2 Dependent variables

4.2.1 Innovation-exporting relationship

Exporting. The 2013 WBES reports firms' exporting status by providing the percentage of goods that a firm exports directly or indirectly. Our measure of exporting is a dummy variable taking the value of "1" if a firm reports direct and/or indirect exports and "0" if otherwise. This measure is consistent with the dummy variable measure used in the 2006/07 WBES.

4.2.2 Exporting-innovation relationship

Innovation. Our study defines innovation as a new or significantly improved product or service. The 2013 WBES reports on this measure. The survey instrument asks respondents whether the firm "introduced new or significantly improved products or services" where "new" means new to the firm but not necessarily new to the market. We measure innovation using a dummy variable taking a value of "1" if the respondents answered yes to this question and "0" if otherwise.

4.3 Independent variables

Lagged Exporting. Past exporting is measured as a dummy variable taking a value of "1" if a firm reported making direct or indirect exports in the 2006/07 WBES.

Lagged Innovation. The 2006/07 WBES reports on past innovation. A dummy variable taking a value of "1" is used to measure innovation where firms report introducing new or significantly improved products or services to the market and "0" if otherwise.

4.4 Mediating variables

4.4.1 *Innovation-exporting relationship*

Market creation. The 2013 WBES and IFS report on market creation activities. The 2013 WBES specifically asks whether the firm introduced new or significantly improved methods of marketing. We use this as a measure of market creation in addition to the measures from 2013 IFS that relates to marketing innovation that includes the introduction or significant changes in packaging, branding, advertising methods, sales channels/sales points, sales promotion among others. Market creation is measured as a dummy variable taking a value of “1” where a firm reports new or significant improvements in marketing methods in the 2013 WBES, and/or the 2013 IFS and “0” if otherwise.

4.4.2 *Exporting-innovation relationship*

Customer feedback. Firms report on the most important source of information or ideas for innovation activities in the 2013 IFS. We use a dummy variable taking a value of “1” where firms report that customer feedback is the most important source of innovation information or ideas for innovation activities and “0” if otherwise.

4.5 Control variables

Age. The 2006/07 WBES reports the year the firm began operations. Age is calculated as the difference between 2007 and the year the firm began operating.

Size. This measure relates to the firm size measured as the number of full-time permanent workers in the firm at the end of the year 2003, and is reported in the 2006/07 WBES.

Foreign ownership. This variable is measured as the percentage of the firm owned by private foreign individuals, companies or organization. This measure of foreign ownership is reported in the 2006/07 WBES.

Human capital. This a dummy variable taking a value of “1” if an employee has attained at least 7 years of education and “0” if otherwise. This measure is reported the 2006/07 WBES.

Managerial education level. The 2006/07 WBES reports on the level of education of managers. We measure managers’ education level as a dummy variable that takes a value of “1” if the manager has attained post-secondary school qualification and “0” if otherwise.

Access to credit. The 2006/07 WBES provides information on whether a firm had a line of credit or a loan from a financial institutions during the survey period. Access to credit is measured as a dummy variable taking a value of “1” where a firm had a line of credit or a loan and “0” if otherwise.

Competition. The 2006/07 WBES reports on two measures of competition. The first relates to the number of competitors a firm faces and specifically asks whether the firm faces more than five competitors. The second item asks firms whether they face competition from informal or unregistered firms. We measure competition as a dummy variable taking a value of “1” where a firm has more than five competitors or faces competition from informal or unregistered firms.

Exports destination. This is a dummy variable taking a value of “1” if a firm exports to developed countries and “0” if it exports to countries located in SSA.

Country dummies. Our study accounts for country differences using country dummies that take a value of “1” if a firm is located in Ghana, Tanzania, or Uganda, and “0” if otherwise. The reference category is Kenya.

4.6 Analysis

We carry out our mediation analysis by means of the product of coefficients approach to uncover the mechanisms underlying the causal relationship between exporting and innovation. We test for mediation effects by means of the Sobel (1982) z-test and use the MacKinnon,

Lockwood, Hoffman, West, and Sheets (2002) distribution of $\frac{\alpha\beta}{\sigma_{\alpha\beta}}$. This approach is deemed as the most accurate for testing mediation effects since it has greater statistical power and maintains an accurate Type I error rate (MacKinnon et al., 2002). The general specification of the logistic regressions we estimate are as follows:

$$\Pr(Y = 1|X) = \frac{\exp(\alpha_1 + cX + dZ + \varepsilon_1)}{1 + \exp(\alpha_1 + cX + dZ + \varepsilon_1)} \quad (4)$$

$$\Pr(M = 1|X) = \frac{\exp(\alpha_2 + aX + dZ + \varepsilon_2)}{1 + \exp(\alpha_2 + aX + dZ + \varepsilon_2)} \quad (5)$$

$$\Pr(Y = 1|X, M) = \frac{\exp(\alpha_3 + c'X + bM + dZ + \varepsilon_3)}{1 + \exp(\alpha_3 + c'X + bM + dZ + \varepsilon_3)} \quad (6)$$

where Y represents exporting/innovation reported in 2013, X represents the mediating variables including market creation activities for the innovation-exporting relation, and customer feedback for exporting-innovation relation; Z represents control variables reported in 2006/07 including lagged exporting, lagged innovation, age, size, foreign ownership, human capital, managerial education level, access to credit, competition, exports destination, and country dummies. The impact of innovation on subsequent exporting and that of the reverse relationship may not be immediate. We therefore introduce lagged dependent variables in our estimation. We make the assumption that exporting reported in 2013 is influenced by previous innovation reported in 2006/07. Similarly, we also make the assumption that innovation reported in 2013 is influenced by previous exporting reported in 2006/07. Furthermore, we also use lagged control variables reported in 2006/07 in our estimation. Introducing lags benefits our analysis by

reducing the possibility of simultaneity bias and improves the ability of making valid causal inferences (Salomon & Shaver, 2005).

5. RESULTS

Table 1 provides descriptive statistics and correlations for our data. About 70 percent of the firms report product innovation in 2013⁸. We also observe that 31 percent of the firms are exporters 2013. Furthermore, about 10 percent of the firms report that customer feedback is an important source of information or ideas for innovation. Contrastingly, over 65 percent of the firms engage in market creation activities. An interesting observation is that about 37 percent of the firms reported product innovation in 2006/07. In addition, 24 percent of the firms were exporters in the same period. We also note that the correlation between product innovation and subsequent exporting has the expected positive sign. Similarly, exporting and subsequent product innovation are positively correlated. Furthermore, market creation and exporting are positively correlated. Similarly, customer feedback and innovation are also positively correlated. Lastly, the control variables are generally correlated with our outcome variables.

We test our hypotheses by estimating Equations 4-6. Our results are summarized in Table 2, which contains 6 models. Models 1-3 report the results of the innovation-exporting relationship. In particular, Model 1 report the results obtained from estimating Equation 4 for the main effect of innovation on subsequent exporting. Model 2 provides the results of the mediated effect of market creation on exporting arising from estimating Equation 5. Model 3 provides results for the full model from Equation 6. The results reported in Model 3 capture the main and mediated effects of innovation on exporting. In a similar fashion, Models 4-6 report the results of the

⁸ The subjective definition of what an innovation is may partly account for such high levels of self-reported innovation in developing countries especially since innovation is likely to be “more incremental and less radical” (Cirera & Muzi, 2016).

exporting-innovation relationship. Model 4 specifically reports on the results of estimating Equation 4 for the main effect of exporting on subsequent innovation. Model 5 provides the results of the mediated effect of customer feedback on innovation from estimating Equation 5. Lastly, estimating Equation 6 yields the results of the full model including the main and mediated effects of exporting on innovation as reported Model 6.

The results in Model 1 reveal that innovation is significantly correlated with subsequent exporting, $r = .375, \rho < .10, 95\% CI [-.056, .806]$. The positive and significant correlation coefficient offers support for our hypothesis predicting a positive relation between innovation and subsequent exporting (H1). Furthermore, several control variables including age, size, and managerial education level have positive and statistically significant coefficients. The results of this model also show that firms in Ghana, Tanzania, and Uganda have a higher likelihood of exporting than firms in Kenya. Sequential correlation analysis examining market creation as a possible mediator of the innovation-exporting relationship are reported in Models 2-3. Model 2 results show that innovation is significantly correlated with market creation $r = .284, \rho < .05, 95\% CI [.019, .549]$. The results reported in Model 3 show that innovation does not have a significant partial effect on subsequent exporting ($\beta = .344, \rho = .116$). Nevertheless, the relation between market creation and exporting is statistically significant ($\beta = .583, \rho < .05$). Following MacKinnon et al. (2002) distribution of $\frac{ab}{\sigma_{ab}}$, the Sobel (1982) z-test indicates that market creation significantly mediates the relation between innovation and exporting, $z = 1.461, \rho < .02$. This finding gives support to our hypothesis proposing that market creation mediates the relation between innovation and exporting (H2). The indirect effect of innovation

on subsequent exporting is $(.284)(.583) = .166$. Following Kenny's (2016) guidelines⁹, this indirect effect is a medium effect size. Given that the direct effect is .344, the resulting total effect coefficient is .510. Accordingly, $.166/.510$, 32.5% of the effect of innovation on subsequent exporting is mediated through market creation.

The results reported Model 4 show that exporting is not significantly correlated with subsequent innovation $r = .238, p = .578, 95\% CI [-.600, 1.08]$. This finding does not support our hypothesis that exporting has a positive relation with subsequent innovation (H3). We surmise that although the coefficient is not statistically significant, its positive sign offers some nuanced support for our hypothesis of a positive relation between exporting and subsequent innovation. Model 4 results further reveal that several control variable including size, foreign ownership, and managerial education level have positive and statistically significant coefficients. Notwithstanding, the coefficient for competition is negative and statistically significant. Additionally, firms in Ghana, Tanzania, and Uganda have a higher likelihood of innovating than firms located in Kenya. Models 5-6 report sequential correlation analyses examining customer feedback as a potential mediator of the exporting-innovation relationship. The results reported in Model 5 reveal that exporting has a significant partial effect on customer feedback, $r = 1.093, p < .01, 95\% CI [.822, 1.364]$. Model 6 results show that the relation between exporting and subsequent innovation is not significant ($\beta = .207, p = .627$). Nevertheless, the relation between customer feedback and innovation is significant ($\beta = .392, p < .05$). The Sobel (1982) z-test indicates that customer feedback significantly mediates the relationship between exporting

⁹ Cohen's (1988) guidelines for effects size are .1 for small, .3 for medium, and .5 for large effects. Kenny (2016) suggest that since the indirect effect is computed as a product of two effects, r should be squared making a small effect size .01, a medium effect size .09, and a large effect size .25. Additionally, where the independent variable is dichotomous, replacing path a 's correlation with Cohen's d such that the effect size is computed as dr and a small effect size is .02, a medium effect size is .15, and a large effect size is .40.

and innovation $z = 2.206, p < .01$. Hence, we find support for our hypothesis that customer feedback mediates the relation between exporting and subsequent innovation (H4). The indirect effect of exporting on innovation is $(1.093)(.392) = .428$, which is a large effect size (see Kenny, 2016). The indirect effect of .428 and direct effect of .207 yield a total effect coefficient of .635. Accordingly, $.428 / .635$, 67.4% of the effect of exporting on subsequent innovation is mediated through customer feedback.

6. DISCUSSION

In this study, we examine the innovation-exporting relationship and its reverse relation. We also pay special attention to the mechanisms underlying these relationships. Our results largely support our hypotheses. We find that the main effect of innovation on exporting is positive and statistically significant. This result has been demonstrated by several empirical studies (Becker & Egger, 2013; Ganotakis & Love, 2011; Palangkaraya, 2012; Roper & Love, 2002; Wakelin, 1988). We also find evidence that market creation mediates the innovation-exporting relationship since the innovation process entails the introduction of new products and services on the marketplace. In agreement with this, our results suggest that the technology-push mechanism accounts for the relationship between innovation and subsequent exporting in the context of SSA. Notwithstanding, this indirect effect is a medium effect size (32.5%), which implies that other mechanisms may also influence this relationship. We assert that the degree of novelty of an innovation may affect the innovation-exporting relation as well. For instance, we are likely to observe a weak indirect effect resulting from market creation where innovations exhibit a low degree of novelty. This is a plausible explanation for our findings, because we define innovation as the introduction or significant improvement of products or services that are new to the firm but not necessarily new to the market. Thus innovations are likely to be more incremental and

less radical (Cirera & Muzi, 2016) exhibiting a low degree of novelty. Similarly, the mechanism by which innovation influences subsequent exporting may also relate to the degree of authenticity of innovations made in Africa. This may imply that market creation activities are dedicated to innovations deemed as original to both the firm and the foreign markets. Yet, authentic innovations might be a rarer occurrence in the context of developing countries because firms are more likely to engage in product imitation. Subject to availability of data, investigating how the degree of authenticity of innovations affects exporting might provide more useful insights on the technology-push mechanism in SSA.

We also find that the main effect of exporting on subsequent innovation is positive but statistically non-significant. Notwithstanding, we argue that the positive relation lends some nuanced support to the “learning-by-exporting” hypothesis. We contend that if innovation is employed as a measure of “learning-by-exporting”, exporting is likely to provide firms in SSA with opportunities for gaining innovation enhancing knowledge from foreign markets (Salomon & Shaver, 2005). Additionally, firms facing competition on foreign markets are more likely to continually undertake innovation (Bindroo et al., 2012) as a means of sustained competitive advantage (Golovko & Valentini, 2011). Furthermore, we find evidence that customer feedback mediates the relation between exporting and innovation to a large extent (67.4%) suggesting that the demand-pull mechanism is very critical in explaining this relationship. Taking into cognizance that the demand-pull mechanism has received scant attention over the past years (Godin & Lane, 2013), this finding gives rise to an important theoretical implication arising from the empirical evidence of the demand-pull mechanism in SSA. We argue that the recognition of market needs arising from customers on the export market constitutes a major driving force of innovation in SSA. Exposure on the export market is likely to increase firms’ knowledge stocks

and knowledge flows arising from firms recognizing assimilating, and sharing new external information that is critical for innovation (Clerides et al., 1998; Kafourous, Buckley, Sharp, & Wang, 2008). Furthermore, we conjecture that there is a likelihood that the presence of knowledge workers in firms affects the assimilation and transformation of knowledge stocks and flows into innovative output. Thus, examining how exporting influences knowledge stocks and flows coupled with the role of knowledge workers in translating external knowledge into innovations may also provide valuable insights for the demand-pull mechanism in the context of SSA.

In conclusion, apart from contributing to the debate on the innovation-exporting relationship in the context of SSA, our paper goes a step further to shift focus on disentangling the mechanisms underlying this interrelationship. This is an area of study that has received scant attention particularly in the African context. We analyze a unique dataset created from repeated cross-sectional surveys by means of mediation analysis. We find that there is a positive relationship between innovation and subsequent exporting. However, the reverse relation is nuanced by a positive albeit non-significant association. Additionally, we find empirical evidence supporting our mediation hypotheses with market creation mediating the innovation-exporting relation to a medium extent and customer feedback providing a much stronger link in the exporting-innovation relation. Thus, our study provides key theoretical insights by advancing our understanding of the mechanisms underlying the innovation-exporting interrelationship in the context of developing countries in SSA.

6.1 Policy implications

Our findings reveal that whilst the main effect for the innovation-exporting relationship is significant, the reverse relation remains unclear. Notwithstanding, the positive albeit non-

significant relation between exporting and innovation provides some nuanced support for the existence of a bi-directional relationship. Furthermore, the technology-push mechanism underlies the innovation-exporting relation to a medium extent. Hence, innovation policies aimed at fostering product innovation by providing incentives may be crucial for exporting. Such policies may be useful in fostering the development of innovations with a high degree of novelty and are likely to promote exporting through the creation of new market space. Moreover, we find evidence that the demand-pull mechanism underlies the exporting-innovation relationship. Customer feedback mediates the exporting-innovation relation to a very large extent. Therefore, state capital expenditure focusing on information and communications technology infrastructure investment is vital in enabling faster response to market needs. Additionally, export promotion policies encompassing instruments such as export subsidies are likely to play a key role in stimulating innovation in SSA.

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Table 1. Descriptive statistics and correlation matrix (n = 506)

| Variable | Mean | Std. Dev. | Min | Max | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|----------------------------------|-------|-----------|------|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 Innovation _t | 0.70 | 0.46 | 0.00 | 1.00 | 1.00 | | | | | | | | | | | | | | | | |
| 2 Exporting _t | 0.31 | 0.46 | 0.00 | 1.00 | 0.11 | 1.00 | | | | | | | | | | | | | | | |
| 3 Customer feedback _t | 0.10 | 0.30 | 0.00 | 1.00 | 0.04 | 0.05 | 1.00 | | | | | | | | | | | | | | |
| 4 Market creation _t | 0.65 | 0.48 | 0.00 | 1.00 | 0.44 | 0.18 | 0.16 | 1.00 | | | | | | | | | | | | | |
| 5 Innovation _{t-6} | 0.37 | 0.48 | 0.00 | 1.00 | 0.10 | 0.18 | -0.07 | 0.06 | 1.00 | | | | | | | | | | | | |
| 6 Exporting _{t-6} | 0.24 | 0.43 | 0.00 | 1.00 | 0.08 | 0.41 | 0.06 | 0.10 | 0.25 | 1.00 | | | | | | | | | | | |
| 7 Exports destination | 0.86 | 0.34 | 0.00 | 1.00 | -0.06 | -0.31 | 0.02 | -0.07 | -0.31 | -0.71 | 1.00 | | | | | | | | | | |
| 8 Age | 16.91 | 12.79 | 1.00 | 87.00 | 0.08 | 0.18 | 0.04 | 0.06 | 0.17 | 0.25 | -0.27 | 1.00 | | | | | | | | | |
| 9 Size | 76.91 | 244.87 | 2.00 | 4000.00 | 0.08 | 0.16 | -0.02 | 0.08 | 0.18 | 0.26 | -0.28 | 0.16 | 1.00 | | | | | | | | |
| 10 Foreign ownership | 16.83 | 35.62 | 0.00 | 100.00 | 0.09 | 0.16 | -0.06 | 0.10 | 0.04 | 0.21 | -0.19 | 0.07 | 0.04 | 1.00 | | | | | | | |
| 11 Human capital | 0.85 | 0.36 | 0.00 | 1.00 | -0.03 | -0.04 | 0.10 | -0.03 | -0.19 | -0.02 | 0.02 | 0.00 | -0.05 | 0.01 | 1.00 | | | | | | |
| 12 Managerial education level | 0.62 | 0.49 | 0.00 | 1.00 | 0.16 | 0.26 | 0.03 | 0.17 | 0.08 | 0.24 | -0.23 | 0.14 | 0.17 | 0.25 | 0.16 | 1.00 | | | | | |
| 13 Access to credit | 0.32 | 0.47 | 0.00 | 1.00 | 0.12 | 0.14 | 0.02 | 0.07 | 0.25 | 0.23 | -0.26 | 0.12 | 0.17 | 0.04 | -0.03 | 0.29 | 1.00 | | | | |
| 14 Competition | 0.49 | 0.50 | 0.00 | 1.00 | -0.06 | 0.00 | -0.02 | -0.05 | 0.21 | 0.03 | -0.03 | 0.07 | 0.02 | -0.07 | -0.06 | -0.10 | 0.04 | 1.00 | | | |
| 15 Ghana | 0.06 | 0.24 | 0.00 | 1.00 | 0.00 | 0.08 | 0.22 | 0.12 | -0.16 | 0.09 | 0.01 | 0.05 | -0.03 | -0.01 | -0.01 | -0.06 | -0.03 | 0.20 | 1.00 | | |
| 16 Tanzania | 0.23 | 0.42 | 0.00 | 1.00 | 0.17 | -0.03 | -0.04 | -0.04 | 0.11 | -0.07 | 0.04 | -0.03 | -0.03 | -0.03 | -0.07 | -0.23 | -0.01 | -0.07 | -0.14 | 1.00 | |
| 17 Uganda | 0.41 | 0.49 | 0.00 | 1.00 | -0.11 | -0.09 | -0.21 | -0.04 | -0.07 | -0.11 | 0.17 | -0.20 | -0.07 | 0.07 | -0.09 | -0.18 | -0.25 | 0.00 | -0.21 | -0.45 | 1.00 |
| 18 Kenya | 0.30 | 0.46 | 0.00 | 1.00 | -0.04 | 0.08 | 0.15 | 0.02 | 0.06 | 0.14 | -0.22 | 0.22 | 0.12 | -0.05 | 0.16 | 0.44 | 0.30 | -0.04 | -0.17 | -0.35 | -0.55 |

Table 2. Logistic regression coefficients with clustered robust standard errors (n = 506)

| Variables | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|----------------------------|------------------------|---------|------------------------------|---------|------------------------|---------|-------------------------|---------|--------------------------------|---------|-------------------------|---------|
| | Exporting _t | | Market creation _t | | Exporting _t | | Innovation _t | | Customer feedback _t | | Innovation _t | |
| <i>Control Variables</i> | | | | | | | | | | | | |
| Age (log) | 0.316*** | (0.040) | -0.079 | (0.085) | 0.326*** | (0.040) | 0.103 | (0.086) | 0.084 | (0.126) | 0.100 | (0.081) |
| Size | 0.339*** | (0.112) | 0.223** | (0.105) | 0.313*** | (0.092) | 0.109*** | (0.022) | -0.011 | (0.086) | 0.107*** | (0.023) |
| Foreign ownership | 0.002 | (0.003) | 0.003*** | (0.001) | 0.002 | (0.003) | 0.002* | (0.001) | -0.006* | (0.003) | 0.002* | (0.001) |
| Human capital | -0.293 | (0.353) | -0.271 | (0.239) | -0.263 | (0.351) | -0.183 | (0.173) | 1.697 | (1.106) | -0.202 | (0.147) |
| Managerial education level | 0.957*** | (0.183) | 0.590*** | (0.107) | 0.890*** | (0.208) | 0.944*** | (0.222) | -0.526 | (0.486) | 0.958*** | (0.240) |
| Access to credit | -0.206 | (0.267) | 0.005 | (0.366) | -0.182 | (0.251) | 0.368 | (0.278) | -0.048 | (0.385) | 0.365 | (0.280) |
| Competition | -0.141 | (0.416) | -0.361 | (0.288) | -0.103 | (0.413) | -0.293*** | (0.092) | -0.386*** | (0.134) | -0.278*** | (0.089) |
| Exports destination | 0.328 | (0.772) | 0.284 | (0.336) | 0.289 | (0.758) | 0.407 | (0.490) | 1.164*** | (0.340) | 0.368 | (0.490) |
| Ghana | 1.099*** | (0.157) | 1.976*** | (0.327) | 0.921*** | (0.086) | 0.966*** | (0.178) | 0.840*** | (0.148) | 0.881*** | (0.146) |
| Tanzania | 0.375*** | (0.112) | 0.135 | (0.135) | 0.350*** | (0.116) | 1.677*** | (0.135) | -1.055*** | (0.327) | 1.708*** | (0.157) |
| Uganda | 0.296*** | (0.095) | 0.227 | (0.201) | 0.270*** | (0.087) | 0.499*** | (0.138) | -2.321*** | (0.286) | 0.553*** | (0.165) |
| <i>Main effects</i> | | | | | | | | | | | | |
| Innovation _{t-6} | 0.375* | (0.220) | 0.284** | (0.135) | 0.344 | (0.219) | 0.304 | (0.391) | -0.290 | (0.361) | 0.310 | (0.394) |
| Exporting _{t-6} | 1.505*** | (0.356) | 0.126 | (0.402) | 1.505*** | (0.312) | 0.238 | (0.428) | 1.093*** | (0.138) | 0.207 | (0.425) |
| <i>Mediation effects</i> | | | | | | | | | | | | |
| Market creation | | | | | 0.583** | (0.287) | | | | | | |
| Customer feedback | | | | | | | | | | | 0.392** | (0.187) |
| Constant | -4.212*** | (0.814) | -0.491 | (1.040) | -4.484*** | (0.774) | -1.249 | (0.774) | -3.836*** | (0.817) | -1.257 | (0.799) |

Robust clustered standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01